

TROPICAL ATMOSPHERE-OCEAN (TAO) PROGRAM  
FINAL CRUISE REPORT  
KA-08-02

Area: Equatorial Pacific between 8°N and 8°S latitude along 165°E Longitude and 8°S to 8°N Latitude along 180° Longitude.

Itinerary:

KA-08-02	<i>Kwajalein, RMI</i>	DEP	<i>March 11, 2008</i>
	<i>Ford Island, Hawaii</i>	ARR	<i>April 5, 2008</i>

**CRUISE DESCRIPTION**

The Tropical Atmosphere Ocean (TAO) array consists of 70 buoys utilizing a taut line mooring configuration used to mount data collection sensors for climate research purposes. Fifteen buoys are serviced by JAMSTEC and the remaining 55 buoys from 95°W longitude to 165°E longitude are serviced by National Data Buoy Center (NDBC). Repair and maintenance of the buoys is performed by NDBC contracted personnel on an annual basis utilizing the NOAA Ship KA'IMIMOANA and NOAA Ship RONALD H. BROWN. The buoy deployment lifecycle are up to 18 months to ensure at least one year of data collection can be completed.

TAO Project Points of Contact:

TAO Project Manager

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TAO Operations Manager

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TAO Cruise Objective and Plan:

The objective of this cruise was the maintenance of the TAO Array along the 165E and 180 meridians. The scientific complement for the cruise embarked at *Kwajalein, RMI* on *March 10, 2008*. The ship departed on *March 11, 2008* and conducted operations on the 165E and 180 meridians. The ship arrived in Honolulu Hawaii on April 5, 2008.

## 1.0 PERSONNEL

### 1.1 CHIEF SCIENTIST AND PARTICIPATING SCIENTISTS:

Chief Scientist: Brian Lake

#### Participating Scientists:

Name	Gender	Nationality	Affiliation
Brian Lake	M	US	NOAA/NDBC
Rick Cole	M	US	NOAA/NDBC
James Rauch	M	US	NOAA/NDBC

## 2.0 TAO DATA INFORMATION

### 2.1 TAO Data Recovery Summary

Mooring Operations were conducted from 8N 165E to 8S 165E and 8S 180 to 8N 180. The following provides details on the data recovery efforts for the buoys serviced.

#### 8N 165E

<b>Buoy ID:</b> PM694A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 4765 m	
<b>Deployed Location:</b> 8 02.09N 165 04.39E		<b>Repair Location:</b> 8 02.3N 165 03.13W	
<b>Buoy Start Date:</b> 8/15/2007		<b>Buoy End Date:</b> Still Active	
<b>Service Description:</b> Rain gauge repair was aborted due to high wind and seas. Buoy riding well, no apparent damage.			
Site Sensor Failures	Date Sensors Failed	Why sensors were failed	Field Service Observations
Rain Gauge	August 16, 2007	Rain rate erratic, not	

		comparable to % time raining.	
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### 5N 165E

<b>Buoy ID:</b> PM640A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 4779 m	
<b>Deployed Location:</b> 05 01.8N 165 0.9E		<b>Recovery Location:</b> 05 01.8N 165 0.2E	
<b>Buoy Start Date:</b> 11/7/06		<b>Buoy End Date:</b> 3/13/08	
<b>Service Description:</b> Light fishing tackle on bridal. T25 Lost. T50 Flooded.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Rain Gauge	August 27, 2007	High rain rate for low % time raining.	
Sea Surface Conductivity/Temperature	November 23, 2007	Salinity showed sudden downward drop, data too low.	

### 2N 165E

<b>Buoy ID:</b> PM695A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 4172 m	
<b>Deployed Location:</b> 1 59.9N 165 0.9E		<b>Visit Location:</b> 1 59.9N 165 0.2E	
<b>Buoy Start Date:</b> 8/17/207		<b>Buoy End Date:</b> Still active	
<b>Service Description:</b> Buoy riding well, no apparent damage. Light sea growth on buoy.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
None			

### 0 165E

<b>Buoy ID:</b> PM696B		<b>Buoy Configuration:</b> Flux	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 4407 m	
<b>Repair Deployed Location:</b> 0 01.5N 165 02.58E		<b>Repair Location:</b> 0 01.01N 165 02.01E	
<b>Buoy Start Date:</b> 8/18/07		<b>Buoy End Date:</b> 3/16/08	
<b>Service Description:</b> Buoy riding well, minor growth on toroid. Two hawsers tied to the tower legs. SSC replaced. Divers replaced TC5 and TC10. TC10 – 14338, No Comms.			

<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Sea Surface Conductivity/Temperature	December 15, 2007	Salinity values went too high.	
75m Conductivity/Temperature	February 9, 2008	Density inversion showed in data, determined to be false data.	

### 0 165E ADCP

<b>Buoy ID:</b> WA008	<b>Buoy Configuration:</b> Narrow Band
<b>Buoy Type:</b> Subsurface	<b>Water Depth:</b> 4395 m
<b>Deployed Location:</b> 0 01.49N 165 13.85E	<b>Recovered Location:</b> 0 01.49N 165 13.85E
<b>Buoy Start Date:</b> 11/9/06	<b>Buoy End Date:</b> 3/15/08
<b>Service Description:</b> Subsurface ADCP was replaced.	

### 2S 165E

<b>Buoy ID:</b> PM645A	<b>Buoy Configuration:</b> Standard		
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 4465		
<b>Deployed Location:</b> 1 58.97S 164 59.9E	<b>Recovered Location:</b> 1 58.3S 165 0.0E		
<b>Buoy Start Date:</b> 11/10/06	<b>Buoy End Date:</b> 3/16/08		
<b>Service Description:</b> Pin broken on SSC. Bottom poison puck missing from SSC. Large hawser tied to buoy leg. Cut in Nilspin at ~400 m.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Sea Surface Conductivity/Temperature	October 10, 2007	Salinity data erratic.	
Anemometer	December 4, 2007		

### 5S 165E

<b>Buoy ID:</b> PM697A	<b>Buoy Configuration:</b> Standard		
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 2511 m		
<b>Deployed Location:</b> 4 59.5S 165 11.8E	<b>Repair Location:</b> 4 59.7S 165 10.9E		

<b>Buoy Start Date:</b> 8/20/2007		<b>Buoy End Date:</b> Still deployed	
<b>Service Description:</b> Repair: Replaced anemometer, rain gauge, and ATRH sensor. Installed new SSC. Hawser tied to tower leg, anemometer broken off and placed in "bird cage"			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Rain Gauge	October 1, 2007	Low rain rate for high % time raining.	
Anemometer	October 6, 2007	All wind data went to zero.	
Sea Surface Conductivity/Temperature	October 10, 2007	Persistent downward drift in salinity data.	
Air Temperature/Relative Humidity	December 8, 2007	RH data too low compared to ship and climatology.	

### 8S 165E

<b>Buoy ID:</b> PM647B		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 3900 m	
<b>Deployed Location:</b> 8 01.59S 164 47.0E		<b>Recovered Location:</b> 8 02.74S 164 52.11E	
<b>Buoy Start Date:</b> 11/12/06		<b>Buoy End Date:</b> 3/19/08	
<b>Service Description:</b> Recovery/Deployment. Anemometer missing, rain gauge top broken off. SSC missing both poison pucks.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were Failed</b>	<b>Field Service Observations</b>
Sea Surface Conductivity/Temperature	January 13, 2008	Salinity dropped too low.	
Anemometer	February 24, 2008	All wind data went to zero.	
Rain Gauge	February 24, 2008	Low rain rate for high % time raining, then data went missing.	

### 8S 180

<b>Buoy ID:</b> PM652A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 5537 m	
<b>Deployed Location:</b> 7 59.6S 179 50.9W		<b>Recovered Location:</b> 7 59.6S 179 50.9W	

<b>Buoy Start Date:</b> 11/16/06		<b>Buoy End Date:</b> 3/22/08	
<b>Service Description:</b> Recovery/Deployment. T250 flooded.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were Failed</b>	<b>Field Service Observations</b>
None			

### 5S 180

<b>Buoy ID:</b> PM698A	<b>Buoy Configuration:</b> Standard
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 5651 m
<b>Deployed Location:</b> 4 58.31S 179 53.80	<b>Visit Location:</b> 4 58.8S 179 54.35W
<b>Buoy Start Date:</b> 8/26/07	<b>Buoy End Date:</b> Still deployed
<b>Service Description:</b> Visit only. Buoy riding well, no evident damage, buoy viewed from 0.2 nm at night.	

### 5S 170W

<b>Buoy ID:</b> PM690A	<b>Buoy Configuration:</b> Standard		
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 5410 m		
<b>Deployed Location:</b> 5 0.13S 170 0.1W	<b>Recovered Location:</b> 5 14.89S 179 16.7W		
<b>Buoy Start Date:</b> 7/27/07	<b>Buoy End Date:</b> 3/24/08		
<b>Service Description:</b> Drifter recovery. Anemometer missing.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were Failed</b>	<b>Field Service Observations</b>
Buoy	September 1, 2007	Buoy flagged as moved.	
Anemometer	October 29, 2007	All wind data went to zero.	
Buoy	December 29, 2007	Buoy flagged as outside watch grid.	

### 2S 180

<b>Buoy ID:</b> PM653B	<b>Buoy Configuration:</b> Standard
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 5331 m
<b>Deployed Location:</b> 2 0.07S 179 53.1W	<b>Recovered Location:</b> 1 59.8S 179 52.52W
<b>Buoy Start Date:</b> 11/19/06	<b>Buoy End Date:</b> 3/25/08
<b>Service Description:</b> Recovery/Deployment.	

<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
None			

### 0 180

<b>Buoy ID:</b> PM699A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 5401 m	
<b>Deployed Location:</b> 0 1.17N 179 54.21W		<b>Repair Location:</b> 0 1.1N 179 54.2W	
<b>Buoy Start Date:</b> 8/28/07		<b>Buoy End Date:</b> Still deployed	
<b>Service Description:</b> Repair. Replaced missing anemometer and installed new SSC. Rain gauge cable chafed – wrapped with electrical tape. Temperature module T7 – no data.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Anemometer	October 7, 2007	All wind data went to zero.	
Sea Surface Conductivity/Temperature	January 20, 2008	Salinity data erratic.	

### 2N 180

<b>Buoy ID:</b> PM700A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 5508 m	
<b>Deployed Location:</b> 2 1.1N 179 47.4W		<b>Repair Location:</b> 2 1.1N 179 47.4W	
<b>Buoy Start Date:</b> 8/29/07		<b>Buoy End Date:</b> Still Deployed	
<b>Service Description:</b> Replaced T25 with diver support. Tube was not downloaded due to communication problems. T-13502 module not downloaded, communication with the sensor could not be established.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were Failed</b>	<b>Field Service Observations</b>
None			

### 5N 180

<b>Buoy ID:</b> PM701A		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 5658 m	
<b>Deployed Location:</b> 5 0.15N 179 54.16W		<b>Visit Location:</b> 4 59.8N 179 54.05W	
<b>Buoy Start Date:</b> 8/30/07		<b>Buoy End Date:</b> Still deployed	

**Service Description:** Buoy riding well, all appears normal.

### 8N 180

<b>Buoy ID:</b> PM693B	<b>Buoy Configuration:</b> Standard
<b>Buoy Type:</b> ATLAS	<b>Water Depth:</b> 5950 m
<b>Deployed Location:</b> 7 59.7N 179 52.6W	<b>Visit Location:</b> 7 59.7N 179 53.5W
<b>Buoy Start Date:</b> 8/6/07	<b>Buoy End Date:</b> Still deployed
<b>Service Description:</b> Buoy riding well, all appears normal.	

### 8N 170W

<b>Buoy ID:</b> PM637B		<b>Buoy Configuration:</b> Standard	
<b>Buoy Type:</b> ATLAS		<b>Water Depth:</b> 5459 m	
<b>Deployed Location:</b> 7 59.65N 170 1.9W		<b>Recovery Location:</b> 7 59.6N 170 1.9W	
<b>Buoy Start Date:</b> 10/27/06		<b>Buoy End Date:</b> 4/1/08	
<b>Service Description:</b> Recovery. With the high seas and swell, it was readily apparent that the buoy was not anchored. The buoy was riding extremely high and moving violently with the waves. Initial contact with the release indicated that it was horizontal on the bottom. Fishing gear on bridle. T modules at 50 and 100 m missing.			
<b>Site Sensor Failures</b>	<b>Date Sensors Failed</b>	<b>Why sensors were failed</b>	<b>Field Service Observations</b>
Buoy	March 12, 2008	Buoy flagged as moved, determined to be drifting slowly.	

## 2.2 CTD Casts Completed

A Sea-Bird 911plus CTD with dual temperature and conductivity sensors was provided by the program. Temperature and conductivity sensors are calibrated yearly at Sea-Bird and sent in for diagnostics as necessary. A Sea-Bird 24-position carousel and twenty four 5-liter Niskin bottles were used to collect water samples for the analysis of salinity.

The following outlines the CTD casts completed during the cruise:

<b>CTD Operations</b>		
<b>Site</b>	<b>Date</b>	<b>Comments</b>

8N 165E	3/12/08	3000 m
7N 165E	3/12/08	1000 m
6N 165E	3/12/08	1000 m
5N 165E	3/13/08	1000 m
4N 165E	3/14/08	1000 m
3N 165E	3/14/08	1000 m
2N 165E	3/14/08	1000 m
1N 165E	3/14/08	1000 m
0 165E	3/15/08	3000 m
1S 165E	3/16/08	1000 m
2S 165E	3/16/08	1000 m
4S 165E	3/17/08	1000 m
5S 165E	3/17/08	1000 m
6S 165E	3/17/08	1000 m
7S 165E	3/18/08	1000 m
8S 165E	3/18/08	3000 m
8S 180	8/22/08	3000 m
7S 180	8/23/08	1000 m
6S 180	8/23/08	1000 m
5S 180	8/23/08	1000 m
4S 180	8/24/08	1000 m
3S 180	8/25/08	1000 m
2S 180	8/25/08	1000 m
1S 180	3/26/08	1000 m
0 180	3/26/08	3000 m
1N 180	3/26/08	1000 m
2N 180	3/27/08	1000 m
3N 180	3/27/08	1000 m
4N 180	3/27/08	1000 m
5N 180	3/28/08	1000 m
6N 180	3/28/08	1000 m
7N 180	3/28/08	1000 m
8N 180	3/29/08	1000 m

The following outlines the scheduled CTD casts not completed and why:

The all half degree CTD's scheduled (between 3N & 3S on each meridian) along with the CTD at 3S165E were not completed in order to save operational time need for other activities.

### 2.3 *Ancillary Science Projects Completed on the Cruise*

The following outlines the ancillary science work performed in conjunction with the TAO operations on the cruise:

### Pacific Marine Environmental Laboratory (PMEL) Argo Profiling CTD Floats

One Argo float was scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All Argo Float deployments were completed as scheduled.

Questions concerning ARGO Floats should be directed to:

Gregory Johnson, NOAA/PMEL  
Tel: (206) 526-6806  
E-mail: [pmel\\_floats@noaa.gov](mailto:pmel_floats@noaa.gov)

or

Elizabeth Steffen, NOAA/PMEL  
Tel: (206) 526-6747  
E-mail: [pmel\\_floats@noaa.gov](mailto:pmel_floats@noaa.gov)

<b>ARGO Floats</b>		
<b>Site</b>	<b>Date</b>	<b>Comments</b>
8-08S 172-59E	3/21/08	

### Atlantic Oceanographic and Meteorological Laboratory (AOML) Surface Drifters

Ten AOML Surface Drifters were scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All AOML Surface Drifter deployments were completed as scheduled.

Questions concerning AOML Surface Drifters should be directed to:

Shaun Dolk, NOAA/AOML  
Global Drifter Center,  
Tel: (305) 361-4546  
Fax: (305) 361-4436  
E-mail: [shaun.dolk@noaa.gov](mailto:shaun.dolk@noaa.gov)

The following outlines the AOML Surface Drifters deployed during the cruise track:

<b>AOML Floats</b>		
<b>Site</b>	<b>Date</b>	<b>Comments</b>
5N 165E	3/13/08	
2N 65E	3/14/08	
0 165E	3/15/08	
2S 165E	3/16/08	
5S 165E	3/17/08	
5S 180	3/23/08	
2S 180	3/25/08	
0 180	3/26/08	
2N 180	3/27/08	
5N 180	3/28/08	

### PCO2 and Nitrate Mapping System and Nutrient Samples

Thirty four 30ml water samples were collected on this cruise. The chief scientist verified and briefed the Operations Officer on the specifications of the water samples to be collected during CTD casts prior to the start of the cruise. All water samples were collected as scheduled.

Questions concerning Nutrient Samples should be directed to:

Cathy Cosca  
NOAA/PMEL  
7600 Sand Point Way NE  
Seattle, Washington 98115  
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E-mail: [cathy.cosca@noaa.gov](mailto:cathy.cosca@noaa.gov)